Michigan's 21st Century Electric Energy Plan

Michigan Agri-Energy Conference 2007

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Executive Directive 2006-2

- Provide safe, reliable, clean, and affordable supply of electric power
- Enhance State's economy and provide affordable rates
- Utilize energy efficiency, renewable and emerging energy production technologies
- Protect the State's natural resources and environment, as well as mitigate future fossil fuel risks
- Identify new technologies
- Foster State's interest in continued growth of alternative and renewable energy
- Recommend legislative and regulatory changes

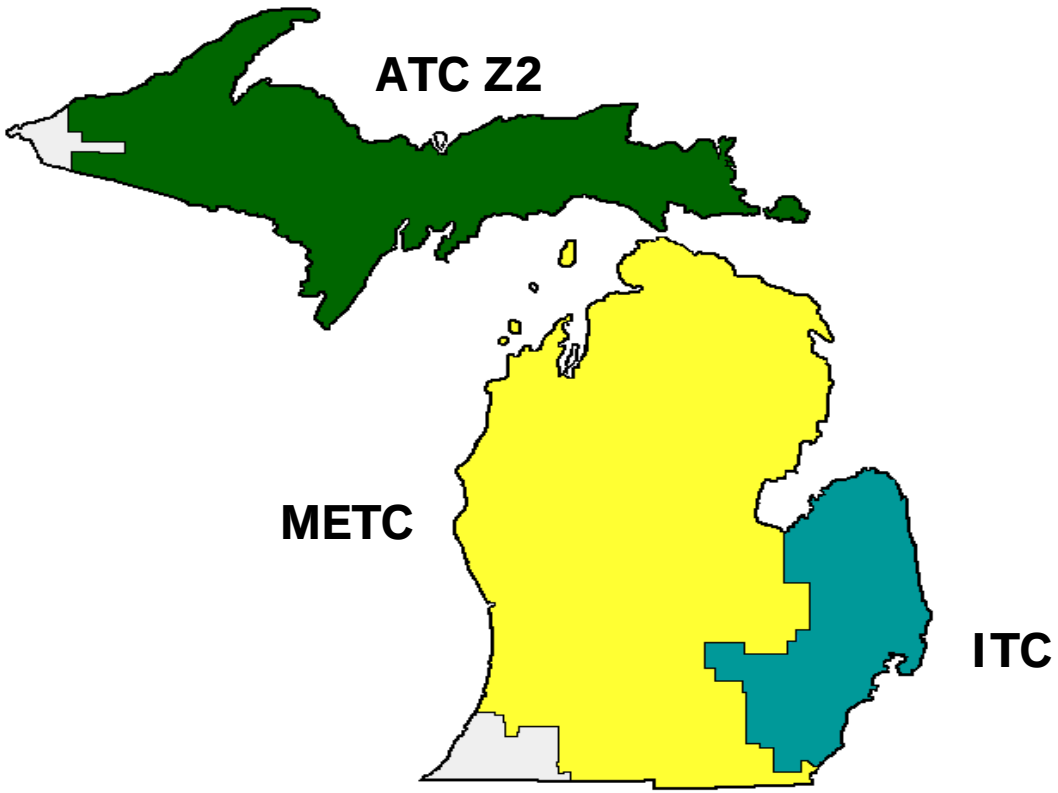
21st Century Energy Plan Process

- Develop a plan to meet Michigan's short and long-term electric energy needs
  - Confirm or modify CNF results
    - Modified forecasts
    - New generation plant costs
    - Available transmission transfer capability
  - Further investigate resource options
  - Identify emerging technologies
- Develop a robust set of policy recommendations designed to implement Michigan's electric energy resource needs

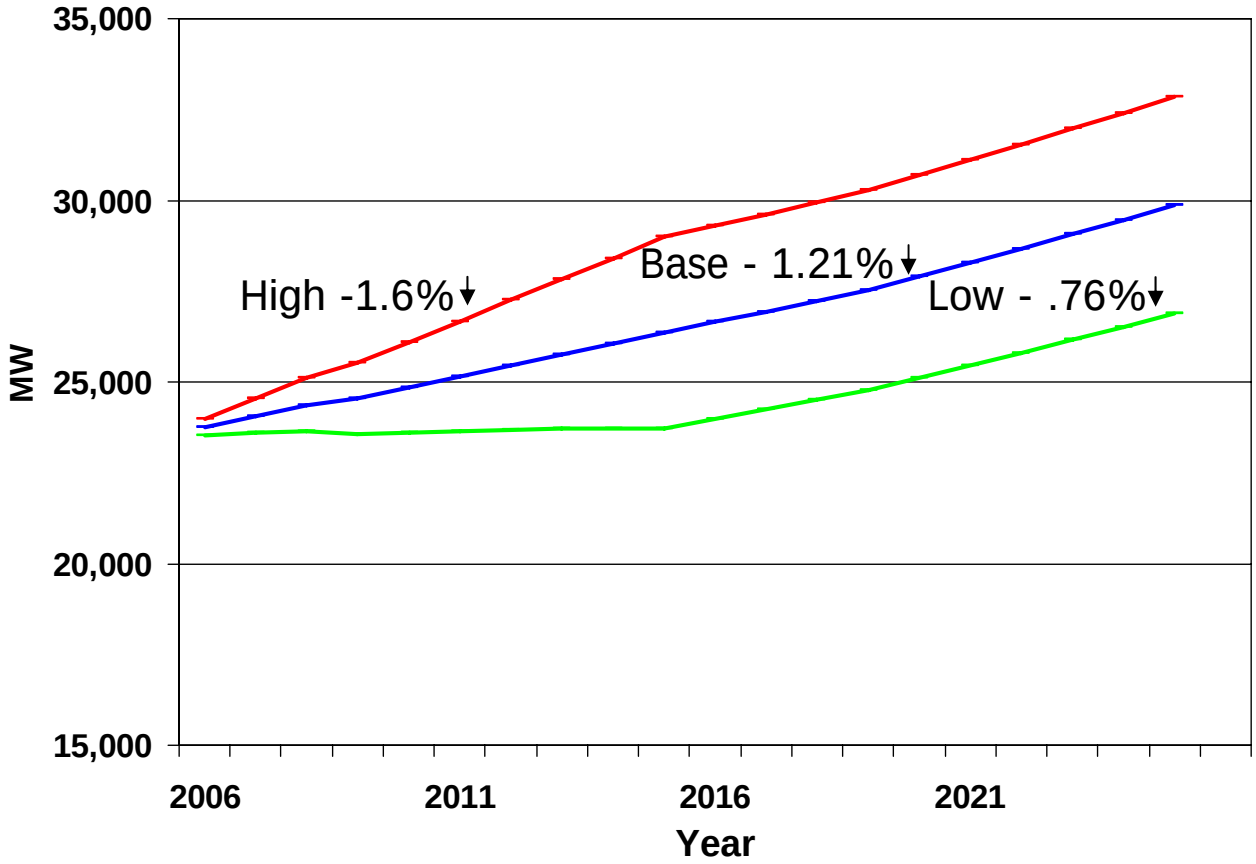
Electric Generation Adequacy

- Forecast energy and demand growth for each region within Michigan
- Compile inventory of current assets (generation and transmission)
- Assess adequacy of current assets
- If needed, determine best set of resources to acquire

Michigan Electric Transmission Company Regions

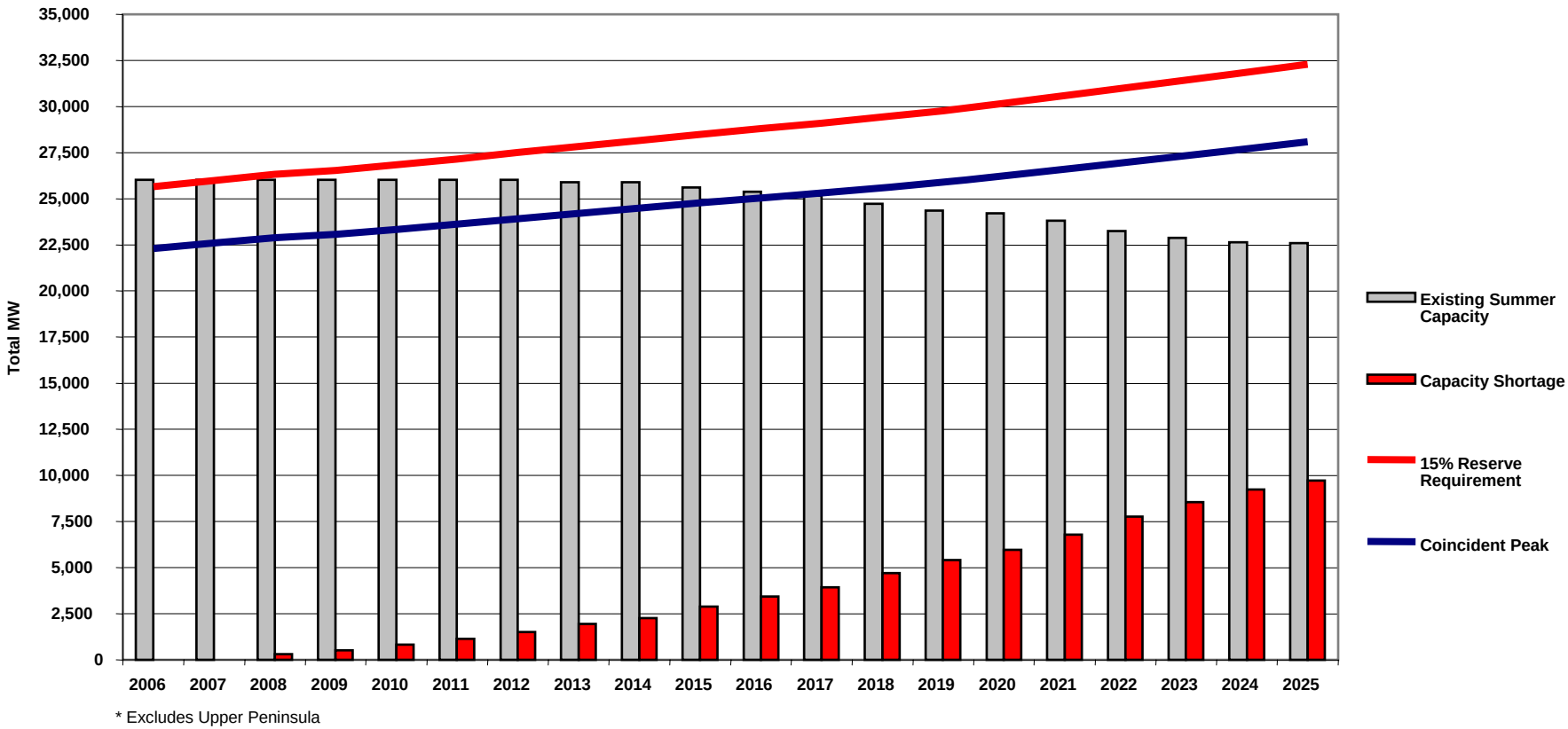


Peak Demand Forecast Sensitivities



Overview of Michigan Generating Resource Needs

MECS Resource Gap Analysis
Summer Peak Load and Resource Balance of Existing System



* Excludes Upper Peninsula

Central Station Technology Options

Technology	Size	$/Kw	FOM	VOM	Heat Rate
Sub-critical PC	500	1,478	44.26	1.86	9,496
Super-critical PC	500	1,551	44.91	1.75	8,864
CFB	300	1,628	46.11	4.37	9,996
IGCC	500	1,785	61.30	.98	9,000
IGCC-PRB	500	1,999	61.30	.98	10,080
Nuclear	1,000	2,352	70.04	.55	10,400
Combined Cycle	500	529	5.57	2.19	7,200
Combustion Turbine	160	425	2.19	3.83	10,450

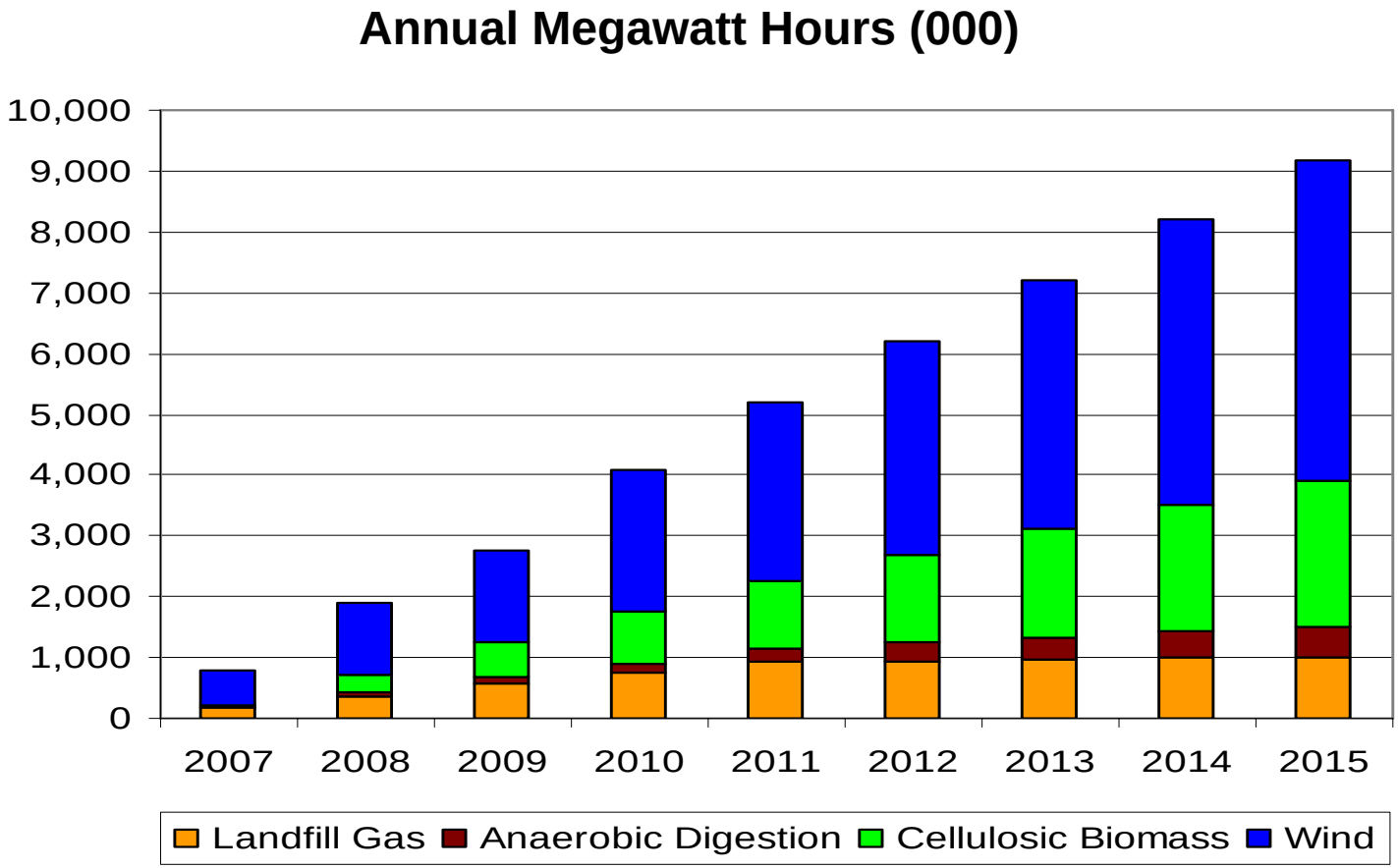
Generating Plant Characteristics with Carbon Sequestration

Plant	Cost	Fixed O&M	Variable O&M	Heat Rate
PC	$ 2,502	$ 75.87	$ 2.95	12,437
IGCC	$ 2,299	$ 73.38	$ 1.18	10,959
IGCC/PRB	$ 2,575	$ 73.38	$ 1.18	12,274

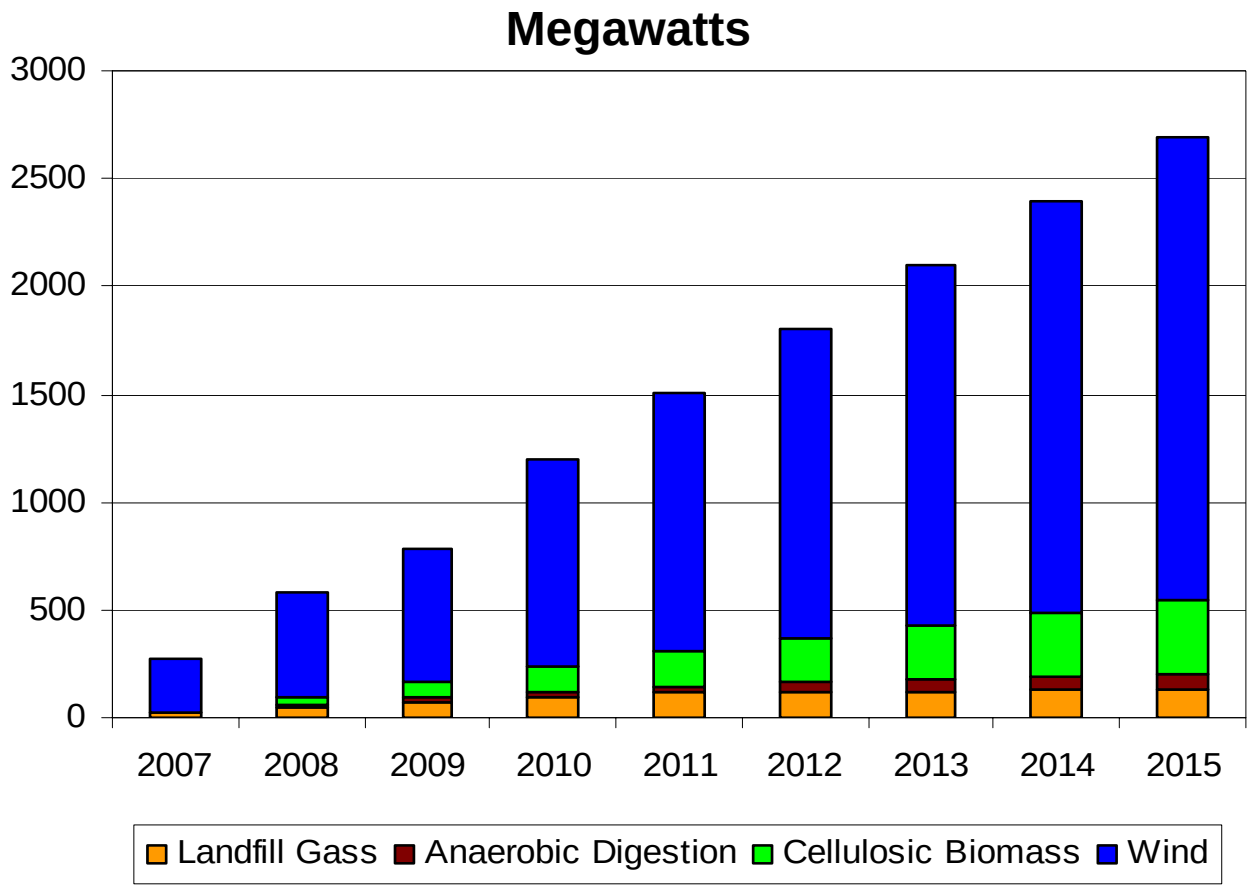
Renewable Energy Options

Renewable Energy System Type	Portfolio Contribution In 2016 (MW)	Cost ($)
Wind	525-2,150	0.072
LFG	131	0.074 (New) 0.070 (Existing)
Anaerobic Digestion	82	0.082
Cellulosic Biomass	385	0.069
Total	**1,123-2.748**	

New Renewable Resources
10% Renewable Portfolio Standard



New Renewable Resources
10% Renewable Portfolio Standard



Energy Efficiency Program

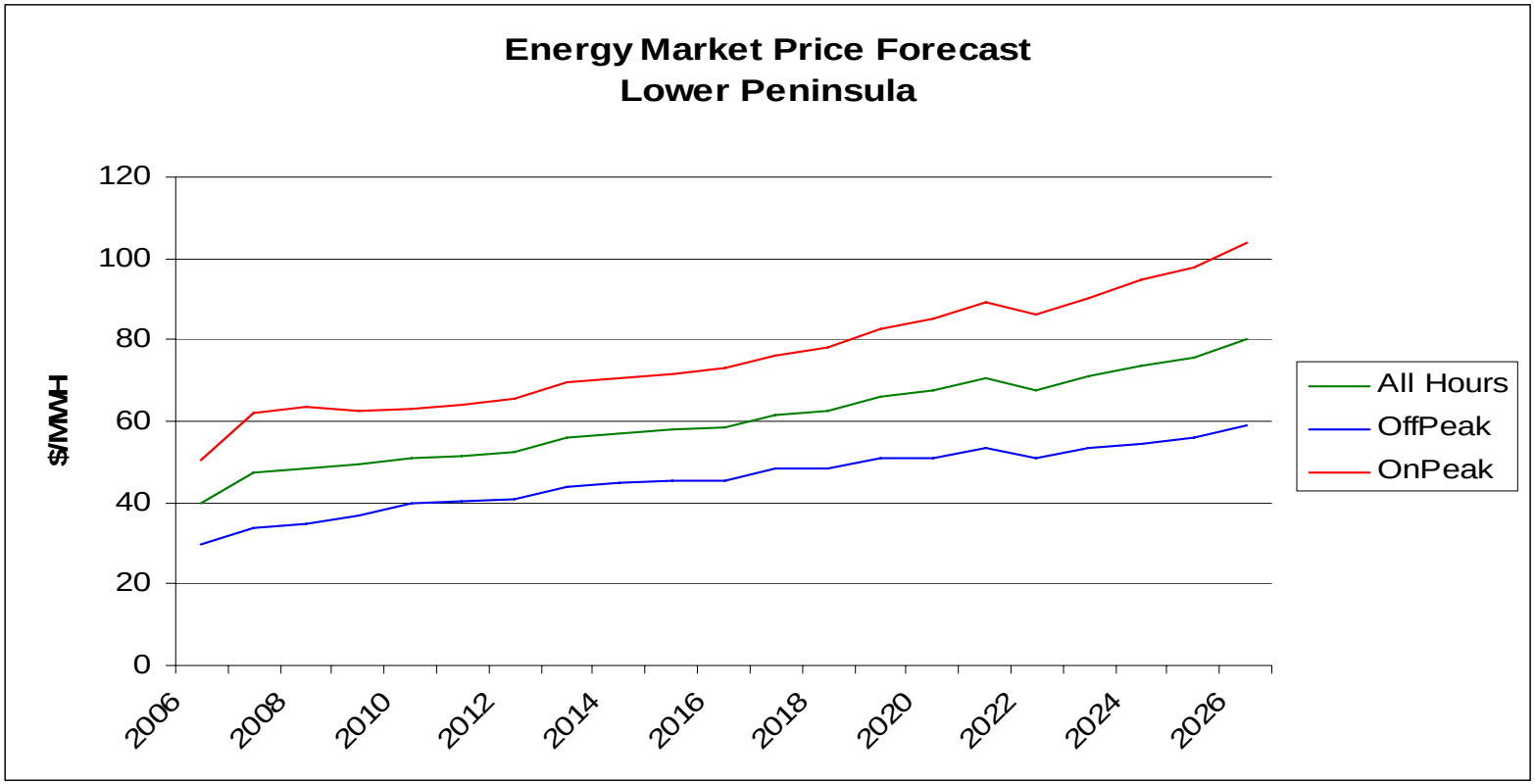
- Aggressive energy efficiency savings
  - 2016
    - 8,474 Gwh's
    - 1,218 Mw's
  - 2026
    - 15,040 Gwh's
    - 2,128 Mw's
- Moderate Program
  - 2016
    - 4,952 Gwh's
    - 660 Mw's
  - 2026
    - 8,650 Gwh's
    - 1,211 Mw's
- Active load Management 569 Mw's by 2016

New Transmission Option Used for Modeling

- 2,000 to 2,500 MW DC transmission line
- From southwest Michigan to northwest Detroit
- $800 million investment
- Operational in 2009

External Market Forecast

- Lower Peninsula 2007 Prices:
  - All Hours: $47.30 / MWH
  - On-Peak: $62.10 / MWH
  - Off-Peak: $33.82 /MWH



Planning Contingencies

- Fuel cost volatility
- Transmission capability
  - Increased transfer capability
  - Decreased transfer capability
- Demand growth
- Greenhouse gas legislation

Planning Scenarios

- Combustion turbines only - Base
- Traditional central station generation
- Energy efficiency
- Renewable energy
- Combined energy efficiency and renewables
- Carbon dioxide controls

Sensitivities

- High demand growth
- Low demand growth
- Expanded transmission capability
- Reduced transmission capability
- Low energy efficiency penetration

Planning Parameters

- Objective Function
  - Minimize Present Worth Utility Cost

- System and Area Constraints
  - 15% Minimum Reserve Margin for MECS
  - 10% Minimum Reserve Margin for METC and ITC by 2015
  - 15% Minimum Reserve Margin for Upper Peninsula
  - No additional units added once minimum reserve targets are met

- Other Constraints
  - No more than one “large” unit per area commissioned at a time

Twenty Year Planning Results

Plan Name	Total Capacity Added mW	CT Capacity mW	CC Capacity mW	PC Capacity mW	Nuclear Capacity mW	Renew-able Capacity mW	Energy Efficiency mW	Ending Reserve Margin %	Ending Peak Demand mW	PVRR $M
Central Station	11,260	1,760	500	9,000	0	0	0	15.52%	29,856	$56,716.9
CS High Load	15,040	3,040	2,000	10,000	0	0	0	15.63%	32,841	$64,116.8
CS Low Load	7,640	640	500	6,500	0	0	0	15.95%	26,870	$49,811.6
CS Reduce Import	11,220	2,720	1,000	7,500	0	0	0	15.40%	29,856	$57,004.8
CS Expanded Trans	10,300	800	1,000	8,500	0	0	0	12.56%	29,856	$57,085.5
Emissions	10,760	1,760	1,000	2,000	6,000	0	0	16.04%	29,856	$70,752.2
Emissions High Load	14,240	2,240	2,000	4,000	6,000	0	0	15.26%	32,841	$79,492.7
Emissions Low Load	7,480	480	0	1,000	6,000	0	0	17.69%	26,870	$62,254.7
Emissions Renew & EE	10,079	480	500	500	5,000	798	2,801	16.89%	26,404	$65,594.5
Emissions EE Only	10,261	960	0	1,500	5,000	0	2,801	16.53%	26,404	$66,707.5
Renewable Generation	11,218	1,920	500	8,000	0	798	0	16.28%	29,856	$57,496.7
Renewable High Load	14,698	2,400	2,000	9,500	0	798	0	15.48%	32,841	$64,758.6
Renewable Low Load	7,238	1,440	0	5,000	0	798	0	15.55%	26,870	$50,797.8
Energy Efficiency	10,581	1,280	0	6,500	0	0	2,801	15.73%	26,404	$53,794.5
EE High Load	14,241	1,440	2,000	8,000	0	0	2,801	15.45%	29,320	$61,040.0
EE Low Load	6,781	480	0	3,500	0	0	2,801	15.53%	23,488	$47,384.1
EE Reduce Pen	10,700	1,280	0	7,500	0	0	1,920	15.36%	27,269	$55,765.2
EE & Renew	10,359	1,760	0	5,000	0	798	2,801	15.95%	26,404	$54,623.2
EE&R High Load	13,899	800	2,000	7,500	0	798	2,801	15.28%	29,320	$61,780.4
EE&R Low Load	6,579	480	0	2,500	0	798	2,801	15.86%	23,488	$48,407.9
EE&R Reduce Pen	10,518	800	500	6,500	0	798	1,920	15.70%	27,269	$56,546.1
CTs Only	11,200	11,200	0	0	0	0	0	15.34%	29,856	$58,987.6
CTs Only High Load	14,880	14,880	0	0	0	0	0	15.18%	32,841	$68,096.6
CTs Only Low Load	7,680	7,680	0	0	0	0	0	16.09%	26,870	$50,737.5

Resource Plans Total Costs
Base Forecast

Plan	Total Cost
• Combustion turbine	$ 59,000
• Renewable energy	57,500
• Traditional central station generation	56,700
• Energy efficiency plus renewable energy	54,600
• Energy efficiency – base case	53,800

Emission Scenario Costs
Base Forecast

Resources Sensitivity	Total Cost
Traditional central station	$ 70,800
Energy efficiency	66,700
Renewable energy and energy efficiency	65,600

Ten Year Resource Additions
Base Forecast

	Energy Efficiency	Renewable Energy	Coal (@500MW)	CT (@160MW)	CC (@500MW)
Efficiency	Base		2	4	
Traditional			4	9	
EE/Renew	Base	7%	1	2	
Transmission Expansion			4	1	1
Combustion Turbine				22	

Modeling Results

- Need to maintain reliability and reserve ratio causes model to select combustion turbines by 2008
- In the base CT only case, the model builds combustion turbines for reliability and purchases economy energy in external markets
- When allowed, the model selects baseload coal units for capacity and energy as soon as its available
- Total electric cost can be reduced by $ 2 billion by enabling traditional generation construction and another $ 2 billion through energy efficiency and renewables
- Base demand and energy forecast always results in baseload being selected

Contingency Review

- Fuel price changes do not alter resource choices
- Transmission expansion does not eliminate baseload construction in Michigan, but does eliminate most combustion turbines
- Low market penetration efficiency program results in lower total electricity costs than traditional generation only cases
- Greenhouse gas controls represent major risk exposure that can be reduced through use of energy efficiency and renewable energy measures

Policy Initiatives

- Renewable energy options
- Energy efficiency
  - Efficiency measures
  - Load management
- Distributed generation
- Central Station – Michigan's hybrid market

Energy Efficiency

- Traditional energy efficiency program
  - Mandatory program for all load serving entities in Michigan
  - Third party administration
  - Triennial review of performance, adoption of goals, and program budget
  - Opt out program for large manufacturing customers
- Initial statewide funding level at $68 million, Commission hearing on subsequent funding levels
- Building and appliance standards
- Load management
- Demand response pilots

Renewable Portfolio Standard

- Standards applicable to all load serving entities in Michigan
- Qualifying renewable energy includes
  - Biomass
  - Geothermal
  - Hydroelectric
  - Solar
  - Wave or water-current
  - Wind
- Target portfolio level 3% by 2009 increasing to 10% by 2015
- Commission to investigate increasing standard to 20% by 2025

Renewable Portfolio Standard (continued)

- Existing renewable count toward 2009 3% standard
- Renewable energy credit program
- Alternate compliance payment program
  - Rate established biannually by Commission
  - Proceeds used to fund renewable energy projects
- Commission can defer standards by one year for hardship or rate impacts
- Penalties for noncompliance

Distributed Energy Technology

- Access to markets
- Interconnection standards
- Net metering legislation
- Distribution use tariffs
- Solar energy pilot
- Residential property tax credit for renewable installations

Additional Recommendations

- Initiate smart grid collaborative
- Apprise local jurisdictions of renewable energy siting guidelines
- Apprise local jurisdictions of revenue based property tax options

Central Station Policy Issues

- Lack of certainty in construction process
  - Customer migration between utility and AES creates customer and revenue uncertainty making it difficult to finance new construction on reasonable terms
  - Approval of need with customer migration
- Cost based rates
- Reliability requirements

Central Station Policy Options

- Fully re-regulate, repeal 2000 PA 141
- Fully deregulate
- Modify Michigan's hybrid market to make it sustainable

Central Station Policy Initiative

- Certificate of Need option for new plant construction
- Integrated resource plan must demonstrate need for new generating plant
  - Energy efficiency
  - Renewable energy standards
  - Demand response programs
  - Transmission options
- Must be accompanied by a financing plan

Central Station (continued)

- Certificate of Need process conducted as public hearing
- Cost recovery of new generating plant tied to customers contributing to the plant's need
- AFUDC/CWIP accounting change
- Move to cost based rates
- Authorize Commission to establish reliability standards

Website for 21st Century Energy Plan

Detailed information is available on the website:

http://www.dleg.state.mi.us/mpsc/electric/capacity/energyplan/index.htm